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☐	L9	multiphase same fluid same flow	595
☐	L8	L7 and simulat$	2
☐	L7	L6 and (pipe or piping or pipelin$)	2
☐	L6	L5 and hydrodynami$	3
☐	L5	L4 and (bas$3 same learn$)	191
☐	L4	L3 and paramet$	264
☐	L3	L2 and (learning)	291
☐	L2	L1 and (phase or multiphase) and (fluid or gas$4 or stream)	524
☐	L1	(nonlinear$ or non-linear) same network same (neural or neuron)	2416

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☐ 1. Document ID: US 20020082815 A1

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L10: Entry 1 of 5 File: PGPB Jun 27, 2002

PGPUB-DOCUMENT-NUMBER: 20020082815
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020082815 A1

TITLE: Method for forming an optimized neural network module intended to simulate the flow mode of a multiphase fluid stream

PUBLICATION-DATE: June 27, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Rey-Fabret, Isabelle	Versailles		FR	
Duret, Emmanuel	Rueil Malmaison		FR	
Heintze, Eric	Meudon		FR	
Henriot, Veronique	Rueil Malmaison		FR	

US-CL-CURRENT: 703/9

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

☐ 2. Document ID: US 20020016701 A1

L10: Entry 2 of 5 File: PGPB Feb 7, 2002

PGPUB-DOCUMENT-NUMBER: 20020016701
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020016701 A1

TITLE: Method and system intended for real-time estimation of the flow mode of a multiphase fluid stream at all points of a pipe

PUBLICATION-DATE: February 7, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Duret, Emmanuel	Rueil-Malmaison		FR	
Heintze, Eric	Meudon		FR	
Rey-Fabret, Isabelle	Versailles		FR	

US-CL-CURRENT: 703/9

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

☐ 3. Document ID: US 5741980 A

L10: Entry 3 of 5 File: USPT Apr 21, 1998

US-PAT-NO: 5741980
DOCUMENT-IDENTIFIER: US 5741980 A

TITLE: Flow analysis system and method

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. Desc | Ima

☐ 4. Document ID: US 5714691 A

L10: Entry 4 of 5 File: USPT Feb 3, 1998

US-PAT-NO: 5714691
DOCUMENT-IDENTIFIER: US 5714691 A

TITLE: Method and system for analyzing a two phase flow

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. Desc | Ima

☐ 5. Document ID: US 5600073 A

L10: Entry 5 of 5 File: USPT Feb 4, 1997

US-PAT-NO: 5600073
DOCUMENT-IDENTIFIER: US 5600073 A

TITLE: Method and system for analyzing a two phase flow

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. Desc | Ima

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Terms	Documents
L1 and L9	5

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US005226092A

United States Patent [19]

Chen

[11] Patent Number: 5,226,092

[45] Date of Patent: Jul. 6, 1993

[54] METHOD AND APPARATUS FOR LEARNING IN A NEURAL NETWORK

[75] Inventor: Kaihu Chen, Shirley, Mass.

[73] Assignee: Digital Equipment Corporation, Maynard, Mass.

[21] Appl. No.: 724,381

[22] Filed: Jun. 28, 1991

[51] Int. Cl.[5] G06K 9/62

[52] U.S. Cl. 382/14; 382/15; 395/50

[58] Field of Search 382/14, 15; 364/513; 371/35; 396/50, 52

[56] References Cited

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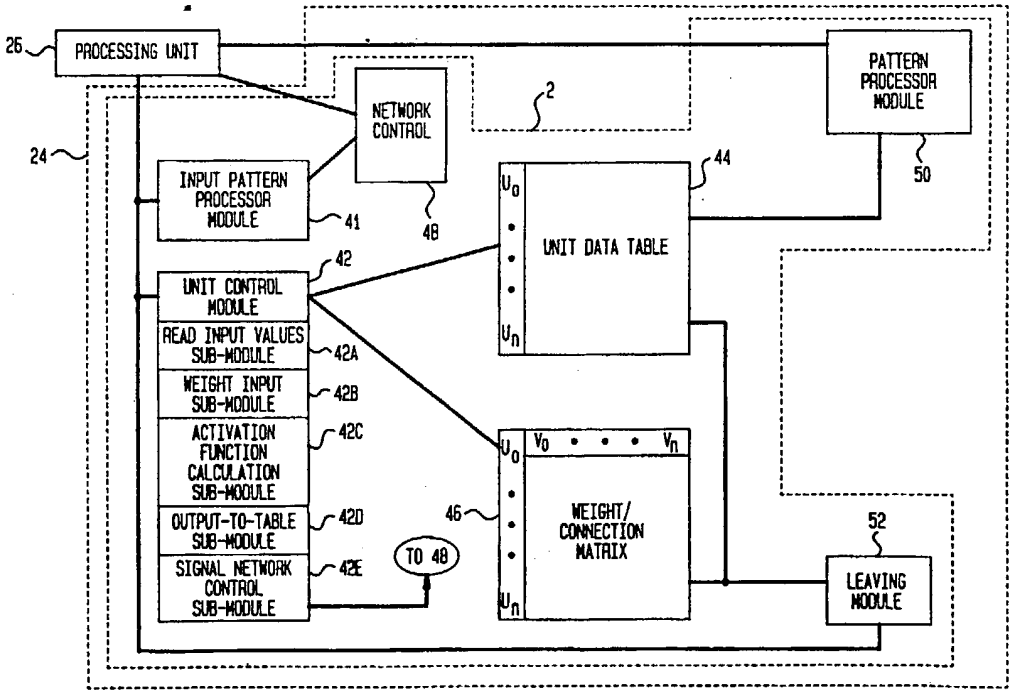
Primary Examiner—Michael T. Razavi
Assistant Examiner—Yon Jung
Attorney, Agent, or Firm—Kenyon & Kenyon

[57] ABSTRACT

A method and apparatus for speeding and enhancing the "learning" function of a computer configured as a multilayered, feed format artificial neural network using logistic functions as an activation function. The enhanced learning method provides a linear probing method for determining local minima values computed first along the gradient of the weight space and then adjusting the slope and direction of a linear probe line after determining the likelihood that a "ravine" has been encountered in the terrain of the weight space.

40 Claims, 13 Drawing Sheets



US005741980A

United States Patent [19]

Hill et al.

[11] Patent Number: 5,741,980

[45] Date of Patent: Apr. 21, 1998

[54] **FLOW ANALYSIS SYSTEM AND METHOD**

[75] Inventors: **Wayne S. Hill**, Westborough; **Bruce N. Barck**, Franklin, both of Mass.

[73] Assignee: **Foster-Miller, Inc.**, Waltham, Mass.

[21] Appl. No.: **784,787**

[22] Filed: **Jan. 16, 1997**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 333,213, Nov. 2, 1994, Pat. No. 5,600,073.

[51] **Int. Cl.**[6] **G01F 1/74**

[52] **U.S. Cl.** **73/861.04**

[58] **Field of Search** 73/861.04, 29.01, 73/23.2, 24.01, 659, 30.03

[56] **References Cited**

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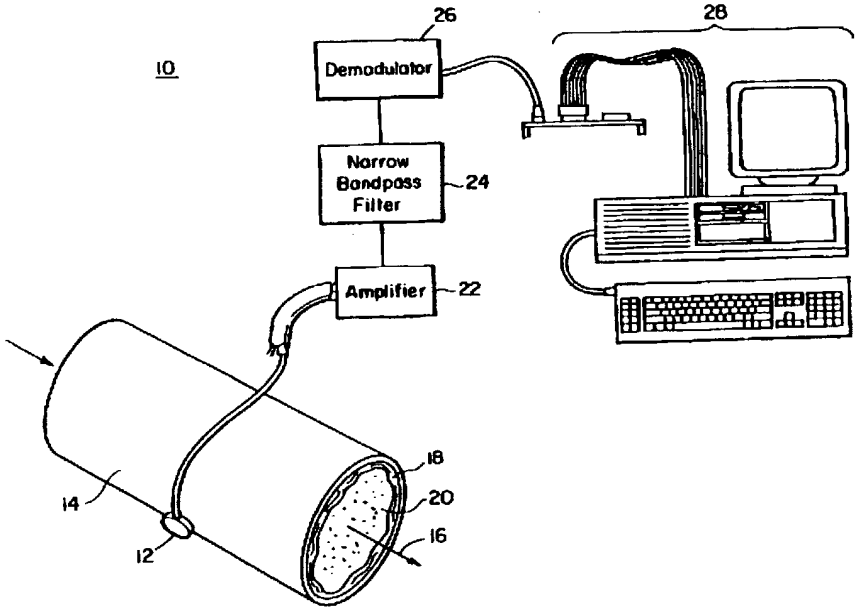
5,390,547	2/1995	Liu	73/861.04
5,419,197	5/1995	Ogi et al.	73/659
5,600,073	2/1997	Hill	73/861.04

Primary Examiner—Richard Chilcot
Assistant Examiner—Jewel Artis
Attorney, Agent, or Firm—Iandiorio & Teska

[57] **ABSTRACT**

A non-invasive flow analysis system and method wherein a sensor, such as an acoustic sensor, is coupled to a conduit for transmitting a signal which varies depending on the characteristics of the flow in the conduit. The signal is amplified and there is a filter, responsive to the sensor signal, and tuned to pass a narrow band of frequencies proximate the resonant frequency of the sensor. A demodulator generates an amplitude envelope of the filtered signal and a number of flow indicator quantities are calculated based on variations in amplitude of the amplitude envelope. A neural network, or its equivalent, is then used to determine the flow rate of the flow in the conduit based on the flow indicator quantities.

50 Claims, 5 Drawing Sheets



US005313559A

United States Patent [19]

Ogata et al.

[11] Patent Number: 5,313,559

[45] Date of Patent: May 17, 1994

[54] METHOD OF AND SYSTEM FOR CONTROLLING LEARNING IN NEURAL NETWORK

[75] Inventors: Hisao Ogata, Kokubunji; Hiroshi Sakou, Shiki; Masahiro Abe, Iruma; Junichi Higashino, Kodaira, all of Japan

[73] Assignee: Hitachi, Ltd., Tokyo, Japan

[21] Appl. No.: 833,127

[22] Filed: Feb. 10, 1992

[30] Foreign Application Priority Data

Feb. 15, 1991 [JP] Japan 3-042957

[51] Int. Cl.[5] G06F 15/18

[52] U.S. Cl. 395/23; 395/76

[58] Field of Search 395/23, 76

[56] References Cited

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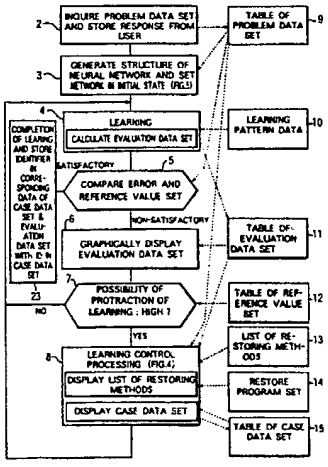
Primary Examiner—Michael R. Fleming
Assistant Examiner—Robert W. Downs
Attorney, Agent, or Firm—Fay, Sharpe, Beall, Fagan, Minnich & McKee

[57] ABSTRACT

A learning control method reduces overall learning time by displaying data related to an appropriate determination of learning protraction and a proper restoring method. Prior to initiating the learning, the user is inquired about the current problem and a problem data set representing items associated with the problem is obtained. Evaluation data indicating a state of learning obtained during the learning on the current problem is sequentially stored and displayed. When there is a high possibility of learning protraction during the learning, a message informing the user is displayed. When the learning is stopped by the user in this case, the problem data set and evaluation data set are stored. Then, a list of restoring methods is displayed and a particular restoring method is selected by the user once the learning is stopped. The learning is restarted on the current problem in accordance with the selected restoring method.

15 Claims, 18 Drawing Sheets



US005550761A

United States Patent [19]

Pauchon et al.

[11] **Patent Number: 5,550,761**

[45] **Date of Patent: Aug. 27, 1996**

[54] **METHOD FOR MODELLING MULTIPHASE FLOWS IN PIPELINES**

[75] Inventors: **Christian Pauchon**, St Germain-En-Laye; **Gilles Ferschneider**, St Symphorien D'Ozon; **Daniel Ferre**, Sautron, all of France

[73] Assignees: **Institut Francais du Petrole**, Rueil Malmaison, France; **Total**, Puteaux, France; **Elf Aquitaine**, Courbevoie, France

[21] Appl. No.: **193,457**

[22] Filed: **Feb. 8, 1994**

[51] **Int. Cl.**[6] **G01F 22/00**

[52] **U.S. Cl.** **364/578**; 73/861.04; 73/61.44

[58] **Field of Search** 364/476, 803, 364/578, 510, 496; 73/861.04, 61.44; 166/250

[56] **References Cited**

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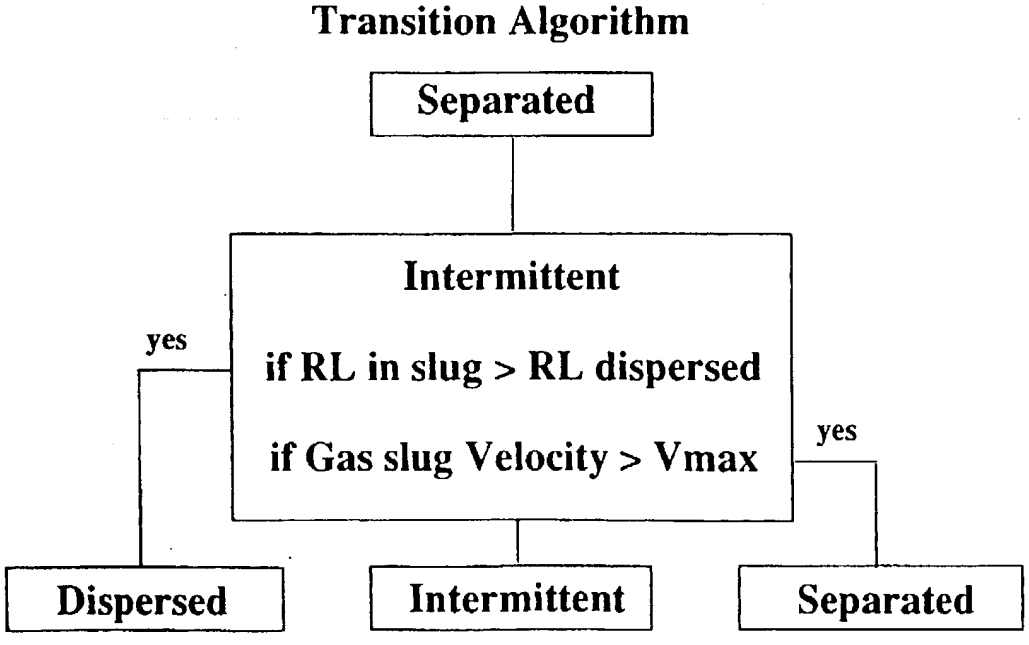
Primary Examiner—Kevin J. Teska
Assistant Examiner—Russell W. Frejd
Attorney, Agent, or Firm—Antonelli, Terry, Stout & Kraus

[57] **ABSTRACT**

A unified hydraulic model has been developed by the method according to the invention which is applicable to any slope and diameter of pipeline and can handle most of the steady state as well as transient multiphase flow regimes encountered in practice. The new modelling method differentiates two types of flow patterns: separated flow patterns (stratified or annular) and dispersed flow patterns. Intermittent flow patterns (slug, churn flow) are a combination of these two patterns. The same concept has been successfully applied for transition criteria between different flow regimes, insuring continuity of the solutions across the transitions. This requirement is very important for simulating transient phenomena. The transient resolution is achieved by an explicit time advancing scheme. The advantages of the method are; its ability to follow wave front propagation, an easy implementation for the resolution of complex pipeline networks. The performance of the resulting unified hydraulic model is demonstrated using a large number of experimental data.

8 Claims, 5 Drawing Sheets



US006092919A

United States Patent [19]

Calise et al.

[11] Patent Number: 6,092,919

[45] Date of Patent: *Jul. 25, 2000

[54] **SYSTEM AND METHOD FOR ADAPTIVE CONTROL OF UNCERTAIN NONLINEAR PROCESSES**

[75] Inventors: **Anthony J. Calise**, Atlanta, Ga.; **Byoung-Soo Kim**, Taejon Su-gu Doonsandong, Rep. of Korea

[73] Assignee: **Guided Systems Technologies, Inc.**, McDonough, Ga.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/510,055**

[22] Filed: **Aug. 1, 1995**

[51] **Int. Cl.**[7] **G05B 13/02**

[52] **U.S. Cl.** **364/148.03**; 364/151; 364/162; 364/424.09; 434/55; 244/194; 244/195

[58] **Field of Search** 364/148, 151, 364/162, 424.088, 424.087, 424.089, 424.09, 972.4, 424.097; 395/85, 87; 483/11; 434/55; 244/194, 195

[56] **References Cited**

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Primary Examiner—William Grant
Assistant Examiner—McDieunel Marc
Attorney, Agent, or Firm—Morris, Manning & Martin, L.L.P.

[57] **ABSTRACT**

A process and neural network architecture for on-line adjustment of the weights of the neural network in a manner that corrects errors made by a nonlinear controller designed based on a model for the dynamics of a process under control. A computer system is provided for controlling the dynamic output response signal of a nonlinear physical process, where the physical process is represented by a fixed model of the process. The computer system includes a controlled device for responding to the output response signal of the system. The computer system also includes a linear controller for providing a pseudo control signal that is based on the fixed model for the process and provides a second controller, connected to the linear controller, for receiving the pseudo control signal and for providing a modified pseudo control signal to correct for the errors made in modeling the nonlinearities in the process. A response network is also included as part of the computer system. The response network receives the modified pseudo control signal and provides the output response signal to the controlled device. The second controller preferably is a neural network. The computer system may include a plurality of neural networks with each neural network designated to control a selected variable or degree of freedom within the system.

2 Claims, 10 Drawing Sheets